

Atlantic islands, it arrived back in the Clyde in July, 1904.

The narrative of the expedition is told by three members of the staff, Mr. R. C. Mossman, the meteorologist and magnetic observer; Dr. J. H. H. Pirie, the medical officer and geologist; and Mr. R. N. Rudmose Brown, the botanist. Each author contributes the chapters describing the work with which he was most concerned. The book perhaps suffers as literature from the difference in treatment of successive chapters, but it has the advantage of describing the whole expedition by the first-hand accounts of men concerned in all the different sections of the work.

The narrative is of great interest. It tells the story of long, thoughtful preparation, of the setting forth of a band of determined men, each well trained in his own line of work, and of their quiet, successful achievement of their purpose. The expedition must be regarded, especially in view of its low cost, as remarkably successful. Its discovery of Coats Land

which affords grounds for hoping that the problem of syntonic signalling is at last nearing practical solution.

Mr. Poulsen will be familiar to readers of NATURE as the inventor of the telephone (see NATURE, vol. Ixii., p. 371, and vol. Ixiv., p. 183). Before describing the experiments shown at the Queen's Hall, it will be advisable to give a short account of the principles on which the new method is based. It has often been pointed out in NATURE that all attempts hitherto made with regard to selective signalling are of a very unsatisfactory nature, and it has been suggested (NATURE, vol. Ixviii., p. 249) that the solution is likely to be found in the application of the principle discovered by Mr. Duddell in the "musical" or "singing" arc. It is precisely that principle that Mr. Poulsen has adopted. The reason for this is sufficiently clear when it is considered that syntony, or tuning between transmitter and receiver, means the emission by the transmitter of sustained vibrations of definite frequency. Only when these are produced is it possible to employ in the receiver a circuit tuned or resonating to this particular frequency.

The main difficulty with all methods of spark transmission is to produce these sustained vibrations. The signal produced by a spark discharge consists of a series of violent pulses each consisting of a short train of strongly damped vibrations of definite frequency. Such tuning as can be done is accomplished by making the natural period of vibration of the receiving circuit the same as the vibration period of the individual pulses, but as the effect of the pulse itself as such is practically as great as that of its component vibrations, it will be readily seen that the tuning is only partial. To make the syntony effectual, the effect of the pulse must be diminished and that of the vibrations increased. In order to do this, the damping of the vibrations must be lessened until the signal is no longer a series of rapidly damped waves, but becomes a continuous succession of undamped, or, at the worst, very slightly damped vibrations, and the culminating

effect of the continuous succession of waves will be far greater.

The problem, therefore, reduces itself to the production of a train of undamped waves, and the manner of its solution was indicated by Mr. Duddell when he discovered the phenomenon of the singing arc (NATURE, vol. Ixiii., p. 182). Mr. Duddell showed that if a continuous current arc, burning under such conditions that a small rise in the current is attended by a small fall of potential—or in symbols for which  $dv/dA$  is negative and numerically greater than the resistance of the shunt circuit—is shunted by a circuit containing self-induction and capacity, there is spontaneously set up in that shunt circuit an alternating current the frequency of which is determined by the "natural" frequency of the circuit. By the use of different inductions and capacities Mr. Duddell produced alternating currents of various frequencies causing the arc to emit a musical note. The frequency of these vibrations was, however, low—as is shown by the fact of the arc emitting a note—and in wireless telegraphy the frequency must be high. Mr. Poulsen has found that by burning the arc in an atmosphere containing hydrogen, by lengthening the



FIG. 2.—Penguin rookery on Graptolite Island. From "The Voyage of the *Scotia*."

determined the hitherto quite unknown southern limit of the Weddell Sea, and has broken the longest unknown line in the coast of Antarctica. As far as can be judged from published information, the *Scotia* will probably be found to have contributed more to Antarctic oceanography and biology than any of the expeditions in the field at the same time. Its deep-sea equipment was excellent, and was fully used, and the description of the quantities of material obtained in the deep-sea hauls justifies the hope that the biological collections will yield most important contributions to our knowledge of the Antarctic fauna.

J. W. G.

#### SYNTONIC WIRELESS TELEGRAPHY.

ON Tuesday evening, at a reception given by Lord Armstrong at the Queen's Hall, Sir William H. Preece, K.C.B., F.R.S., being in the chair, a very important and interesting demonstration was given by Mr. Valdemar Poulsen before a large audience, which included, among others, H.R.H. the Duchess of Argyll, the Duke of Argyll, and the Danish Ambassador, of a new development of wireless telegraphy

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arc and by placing it in a strong magnetic field, the frequency can be enormously increased, and as many as a million vibrations a second may be obtained. Mr. Poulsen also finds that it is advantageous to have the anode of copper and the cathode of carbon, but when high currents are used the anode must be cooled by water running through tubes arranged for this purpose.

Mr. Poulsen showed several interesting experiments, illustrating the delicacy of the receiving circuit, in that on the slightest variation of frequency the activity of the receiving circuit ceases. Another experiment with a generator the oscillation circuit of which was connected directly to a resonator the frequency of which was in agreement with that of the generator circuit (about one hundred and seventy thousand oscillations per second), showed stationary oscillations with maximum tension at the top of the coil, and gave a peculiar soundless flame. As indicating the enormous amount of energy produced, Mr. Poulsen showed several experiments—lighting six incandescent lamps which were simply connected to a coil of wire which was brought near the oscillation circuit; destruction of a copper ring of wire when brought near, &c.

Turning to the transmitter used by Mr. Poulsen, there are two things of special interest, viz. the coupling and the signalling. As regards the coupling, the usual method employed is a very loose or close coupling, and the tuning is very sharp in either case. As regards the methods of signalling, various arrangements may be employed, but perhaps the most simple is by causing the key to short circuit a resistance periodically, which resistance must be large enough to reduce the amplitude and be included in the antenna-circuit. This method reduces sparking and permits of quick telegraphing. One may also telegraph by varying the tension of the magnetic field or of the feeding current, or altering the amount of hydrogen round the arc.

The receiving circuit for continuous waves includes an oscillation circuit with the least possible damping and in loose connection with the antenna-circuit. Owing to the continuity of the waves the detector may be arranged in such a way that it only intermittently forms part of the circuit of oscillation. Hence damping is avoided which the permanent inclusion of the detector would introduce. The apparatus which causes the intermittent contact is known as the "Ticker," and the usual material used for the contacts is either gold wire or German silver. Mr. Poulsen claims to be able to tune in practice to one per cent., and has received three messages simultaneously without mutual interference, the difference of wave-length in this instance amounting to three per cent.

Under the new method of undamped continuous waves Mr. Poulsen has sent a message from Lyngby, near Copenhagen, to North Shields, a distance of 530 miles, with a pole only 100 feet in height, for the expenditure of one kilowatt, and he hopes from this shortly to be able to get perfect communication across the Atlantic.

The chief advantages of Mr. Poulsen's system appear, therefore, to be:—(a) Extreme accuracy of tuning—thus ensuring selective signalling with no interference. (b) Freedom from interferences due to atmospheric electricity. (c) Greater efficiency due to accuracy of tuning and to the low potential of the electric surges impressed upon the aerial radiator.

Mr. Poulsen hopes that undamped and continuous wave-trains may yet be adapted to wireless telephony. The demonstration certainly proved that a great advance has been made in wireless telegraphy, and should the methods employed be brought into regular commercial use, there can be little doubt that Sir

W. H. Preece's remark that probably the "death knell" of spark telegraphy has been sounded will prove to be an accomplished fact. In the first place syntony will become a really practical affair, and interference troubles between neighbouring stations, which have to a certain degree been responsible for the necessity of international legislation, will disappear. Secondly, the cost of transmission will be diminished, as with undamped oscillations the energy used in transmission can be enormously diminished. For the same reason the effective distance over which messages can be transmitted will be correspondingly increased, and we may hope to see the real establishment of that Transatlantic communication so often announced and so often abandoned. J. L. M.

#### THE MARINE BIOLOGICAL ASSOCIATION AND INTERNATIONAL FISHERY INVESTIGATIONS.

Lord CARRINGTON, President of the Board of Agriculture and Fisheries, paid a visit to the Lowestoft Laboratory of the Marine Biological Association on Friday, November 23, in order to see the work which is being carried on at the laboratory in connection with the international fishery investigations in the North Sea. The principal features of the work were illustrated by means of a number of specimens and charts, which were explained by Dr. Garstang, the naturalist in charge of the laboratory, and by his assistants.

After being entertained at luncheon at the Royal Hotel by the council of the Marine Biological Association, Lord Carrington, who was accompanied by Mr. W. E. Archer, assistant secretary to the Board, visited the steam trawler *Huxley*, which carries out the investigations at sea.

Among those present to meet Lord Carrington were Mr. E. Beauchamp (M.P. for Lowestoft), the Mayor of Lowestoft, Mr. C. Hellyer (chairman of the committee of the National Sea Fisheries Protection Association), Mr. Deputy Sayer, of London, Mr. A. B. Capps and Mr. J. Jackman, of Lowestoft, and the following members of the council of the Marine Biological Association:—Dr. A. E. Shipley, F.R.S. (chairman), Prof. Bourne, Sir Charles Eliot, K.C.M.G., Dr. Harmer, F.R.S., Dr. Lister, F.R.S., Prof. D'Arcy Thompson, C.B., Dr. Chalmers Mitchell, F.R.S., Mr. G. L. Alward, Mr. J. A. Travers (treasurer of the association), and Dr. E. J. Allen (secretary and director), together with the members of the Lowestoft staff (Dr. W. Garstang, Mr. J. O. Borley, Dr. W. Wallace, Mr. R. A. Todd, and Mr. A. E. Hefford).

Under the present arrangement the scheme of international investigations terminates in July, 1907, but the council of the Marine Biological Association, in view of the importance of the work already accomplished, is urging His Majesty's Government to continue similar researches upon a more permanent basis. In this connection the following statement of the views of the council has been forwarded to His Majesty's Government:—

The council of the Marine Biological Association consider that the experience of the past few years justifies the opinion (1) that scientific investigations carried out on the deep-sea fishing grounds by means of a special sea-going steamer have produced results of great value concerning the biology of our food-fishes; (2) that a continuance of such experimental investigations is urgently required, in addition to the regular maintenance of market statistics and observations, in order to provide the exact knowledge necessary for the formulation of effective measures for the improvement of the supply of fish; and (3) that the advantages of international cooperation in